

## ELECTROMAGNETIC RADIATION



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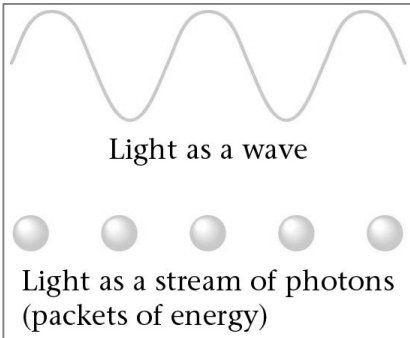
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Electromagnetic radiation.



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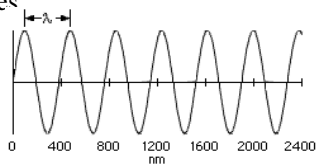
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## Electromagnetic Radiation

- Most subatomic particles behave as **PARTICLES** and obey the physics of waves



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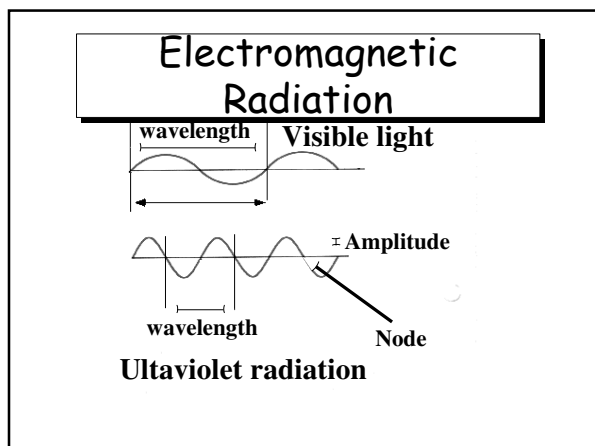
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### Electromagnetic Radiation

- Waves have a frequency
- Use the Greek letter “nu”,  $\nu$ , for frequency, and units are “cycles per sec”
- All radiation:  $\lambda \cdot \nu = c$   
 where  $c$  = velocity of light =  $3.00 \times 10^8$  m/sec

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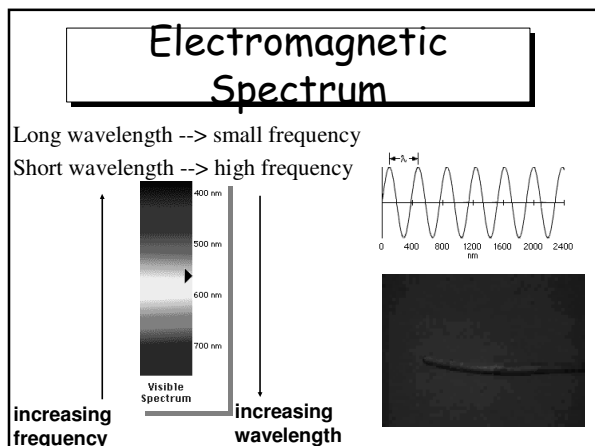
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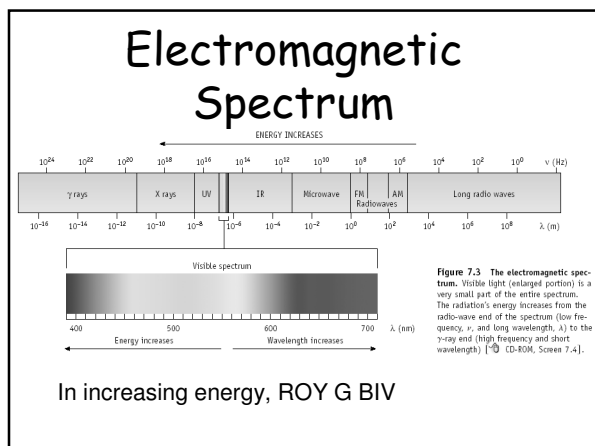
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Electricity off.  
Colorless gases.

Electricity on.  
Excited electrons.

Gases such as neon are colorless. However, if electricity is passed through the gas, the atoms are excited, and the gas glows.

## Excited Gases & Atomic Structure

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## Locating Electrons

❖ **Orbital Diagrams:** Diagrams showing location and spin of individual electrons

O    ↑↓    ↑↓    ↑↓ ↑ ↑

8e<sup>-</sup>    1s       2s                    2p

❖ **Electron Configurations:** Summary of total electrons in an orbital type

❖ 1s<sup>2</sup> 2s<sup>2</sup> 2p<sup>4</sup>

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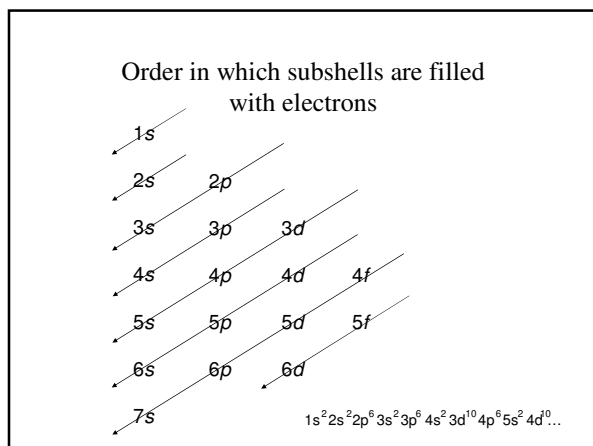
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## Filling Rules for Electron Orbitals

**Aufbau Principle:** Electrons are added one at a time to the lowest energy orbitals available until all the electrons of the atom have been accounted for.

**Pauli Exclusion Principle:** An orbital can hold a maximum of two electrons. To occupy the same orbital, two electrons must spin in opposite directions.

**Hund's Rule:** Electrons occupy equal-energy orbitals so that a maximum number of unpaired electrons results.

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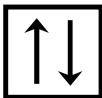
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## General Rules

- Pauli Exclusion Principle
  - Each orbital can hold TWO electrons with opposite spins.



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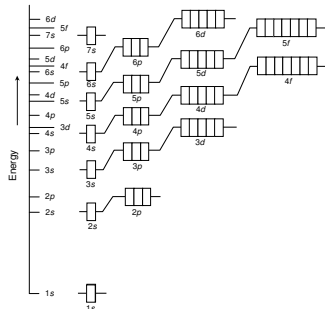
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## General Rules

### Aufbau Principle

- Electrons fill the lowest energy orbitals first.
- “Lazy Tenant Rule”




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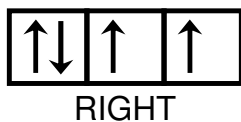
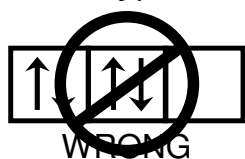
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## General Rules

### • Hund's Rule

- Within a sublevel, place one electron per orbital before pairing them.
- “Empty Bus Seat Rule”




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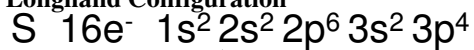
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## Notation



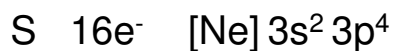
### • Longhand Configuration



Core Electrons

Valence Electrons

### • Shorthand Configuration




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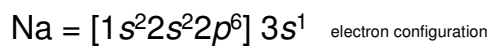
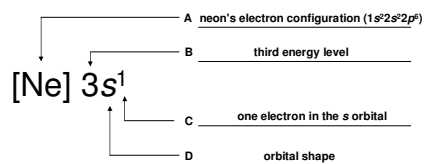
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## Shorthand Configuration




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## Shorthand Configuration

Element symbol	Electron configuration
<u>Ca</u>	<u><math>[\text{Ar}] 4s^2</math></u>
<u>V</u>	<u><math>[\text{Ar}] 4s^2 3d^3</math></u>
<u>F</u>	<u><math>[\text{He}] 2s^2 2p^5</math></u>
<u>Ag</u>	<u><math>[\text{Kr}] 5s^2 4d^9</math></u>
<u>I</u>	<u><math>[\text{Kr}] 5s^2 4d^{10} 5p^5</math></u>
<u>Xe</u>	<u><math>[\text{Kr}] 5s^2 4d^{10} 5p^6</math></u>
<u>Fe</u>	<u><math>[\text{He}] 2s^2 2p^6 3s^2 3p^6 4s^2 3d^6</math> Or <math>[\text{Ar}] 4s^2 3d^6</math></u>
<u>Sg</u>	<u><math>[\text{Rn}] 7s^2 4f^{14} 5d^4</math></u>

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